SECTION 2JI

FENCING

PART I - GENERAL

1.1 DESCRIPTION

A. Scope.
   1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install fencing.
   2. The extent of fencing is shown on the Drawings.
   3. The types of fencing and appurtenances include the following:
      a. Galvanized steel systems.
      b. Aluminum coated steel systems.
      c. Swing gates.
      d. Sliding gates.
      e. Gate operators.
      f. Accessories and fittings.

B. Related Sections;
   1. Section 3D, Cast-In-Place Concrete.

1.2 QUALITY ASSURANCE

A. Erector Qualifications: Erector must be a firm experienced in the erection of fencing of the type specified.

B. Design Criteria: Comply with the standards of the Chain Link Fence Manufacturer's Institute for "Galvanized Steel Chain Link Fence Fabric" and Federal Specification ®R F-191 (latest revision), unless otherwise shown or specified.

C. Source Quality Control: Provide each type of fence and gate as a complete unit produced by a single manufacturer, including necessary erection accessories, fitting and fastenings.

D. Reference Standards. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
   1. ASTM A 53, Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless.
   2. ASTM A 121, Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
   3. ASTM A 153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   4. ASTM A 392, Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
   5. ASTM A 491, Specification for Aluminum-Coated Steel Chain-Link Fence.

6. ASTM A 585, Specification for Aluminum-Coated Steel Barbed Wire.
7. ASTM C 33, Specification for Concrete Aggregates (Including Tentative Revision).
8. ASTM C 150, Specification for Portland Cement.
9. ASTM G 23, Standard Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.
10. Chain Link Fence Manufacturer's Institute, Galvanized Steel Chain- Link Fence Fabric.
11. Federal Specification, RR-F-191 (latest revision), Fencing, Wire and Post, Metal (Chain Link Fence Fabric).

1.3 SUBMITTALS

A. Samples: Submit for approval the following:
   1. Approximately 6 inches long, or 6 inch square of fabric material, framework members, and typical accessories, in a full range of manufacturer's standard and custom colors. ENGINEER'S review will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the CONTRACTOR.

B. Shop Drawings: Submit for approval the following:
   1. Plan layout and details illustrating fence height, location and sizes of posts, rails, braces, gates, footings, operators, hardware list and erection procedures.
   2. Copies of manufacturer's technical data test reports on physical properties, and installation instructions for steel fences and gates.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: :Deliver material in manufacturer's original packaging with all tags and labels intact and legible.

B. Handling of Materials: Handle and store material in such manner as to avoid damage.

PART 2 - PRODUCTS

2.1 GENERAL

A. Pipe sizes specified are commercial pipe sizes.

B. Tube sizes specified are nominal outside dimension.

C. Roll-formed section sizes are the nominal outside dimensions.

D. Finish for Framework and Appurtenances: Furnish the following finishes for steel framework and appurtenances:

1. Galvanized finish with minimum weights of zinc as follows:

a. Pipe: ASTM A 53, Schedule 40, 1.8 ounce zinc per square foot.

b. Hardware and Accessories: ASTM A 153, zinc weight per Table 1, Federal Specification RR-F-191 (latest revision).

2.2 FABRIC

A. Furnish chain link fabric as follows:

1. One-piece fabric widths, for fence heights up to 12 feet.
   a. No. 6 gage wires.
   b. Gage of wire specified shall be wire gage without any additional coatings.
2. 2-inch mesh.
3. Top selvages twisted and barbed and bottom selvage knuckled for fabric over 60 inches high.
4. Galvanized finish with not less than 1.2 ounces zinc per square foot, complying with ASTM A 392, Class I.
5. Aluminized finish with not less than 0.40 ounces aluminum per square foot, complying with ASTM A 491, Class II.

2.3 POSTS, RAILS AND BRACES

A. End, Corner, and Pull Posts: Furnish end, corner, and pull posts of the minimum sizes and weights as follows:

1. Over 6 feet fabric height:
   a. 2.375 inches OD pipe weighing 3.65 pounds per linear foot.

B. Line Posts: Furnish line posts of the minimum sizes and weights as follows. Space posts 10 feet on centers maximum,-unless otherwise shown.

1. over 6 feet fabric height:
   a. 2.375 inches OD pipe weighing 3.65 pounds per linear foot.

C. Gate Posts: Furnish gate posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:

1. Over 6 feet and up to 13 feet wide:
   a. 4 inches OD pipe weighing 9.10, pounds per linear foot.

D. Top Rail: Furnish top rails, unless otherwise shown, of the following:
   1. 1.660 inch OD pipe weighing 1.35 pounds per linear foot.
   2. Furnish in manufacturer's longest lengths, with expansion type couplings, approximately 6 inches long, for each joint. Provide means for attaching the top rail securely to each gate, corner, pull, and end post.

G. Tension Wire: Furnish tension wire consisting of aluminized 7 gage coiled spring wire.
   1. Locate at bottom and top of fabric.

H. Barbed Wire Supporting Arms: Furnish pressed steel, wrought iron, or malleable iron barbed wire supporting arms, complete with provisions for anchorage to posts attaching 3 rows of barbed wire to each arm. Supporting arms shall be integral with post top weather cap. Provide following type:
   1. Single vertical arm, one for each post where shown.

I. Barbed Wire: 2 strand, 11 gage wire with 14 gage, 4-point aluminum barbs spaced 5 inches on center, as follows:
   1. Galvanized, complying with ASTM A 121, Class 3.
   2. Aluminized, complying with ASTM A 585, Class 2.

J. Post Tops: Pressed steel, wrought iron, or malleable iron, designed as a weathertight closure cap, for tubular posts. Furnish one cap for each post unless equal protection is afforded by combination post top cap and barbed wire supporting arm, where barbed wire is required.
   1. Furnish caps with openings to permit through passage of the top rail.

K. Stretcher Bars: One piece lengths equal to full height of fabric, with a minimum cross-section of 3/16 inch by 3/4 inch. Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post, except where fabric is integrally woven into the post.

L. Stretcher Bar Bands: Steel galvanized, 0.078 to 0.108 inches thick depending on post diameter, spaced not over 15 inches on center to secure stretcher bars to end, corner, Dull, and gate posts.
   1. Bands may also be used with special fittings for securing rails to end, corner, pull and gate posts.

2.4 GATES

A. Fabricate gate perimeter frames of tubular members. Provide additional horizontal and vertical members to ensure proper gate operation and for

attachment of fabric, hardware and accessories. Space so that frame members are not more than 8 feet apart. Fabricate as follows:

1. Over 6 feet high, or leaf width exceeding 8 feet:
   a. 1.90 inch OD pipe weighing 2.72 pounds per linear foot.

B. Assemble gate frames by welding or with special malleable or pressed steel, fittings and rivets for rigid connections. Use same fabric as for fence. Install fabric with stretcher bars at vertical edges. Bars may also be used at top and bottom edges. Attach stretchers to gate frame at no more than 15 inches on center. Attach hardware with rivets or by other means which will provide secrity against removal or breakage.

C. Install diagonal cross-bracing consisting of 3/8-inch diameter adjustable length truss rods on gates where necessary to ensure frame rigidity without sag or twist.

1. Where barbed wire is shown above gates, extend the end members of gate frames 1 foot-0 inch above the top member and prepare to receive 3 strands of wire. Provide necessary clips for securing wire to extensions.

D. Gate Hardware: Furnish the following hardware and accessories for each gate.

1. Hinges: Pressed or forged steel or malleable iron to suit gate size, non-lift-off type, offset to permit 180 degrees gate opening. Provide 1-1/2 pair of hinges for each leaf over 6 feet nominal height.
2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.
3. Keeper: Provide keeper for all vehicle gates, which automatically engages the gate leaf and holds it in the open position until manually released.
4. Double Gates: Provide gate stops, for double gates, consisting of mushroom type or flush plate with anchors. Set in concrete to engage the center drop rod or plunger bar. Include locking device and padlock eyes as an integral part of the latch, using one padlock for locking both gate leaves.
5. Swing Gate Operators

A. Wire Ties: For tying fabric to line posts, use 9 gage wire ties spaced 12 inches on center. For tying fabric to rails and braces, use 9 gage wire ties spaced 24 inches on center. For tying fabric to tension wire, use 11 gage hog rings spaced 24 inches on center. Finish of ties to match fabric finish.

1. Manufacturer's standard procedure will be accepted if of equal strength and durability.

B. Concrete: Provide concrete consisting of portland cement complying with ASTM C 150, aggregates complying with ASTM C 33, and clean water. Mix materials to obtain concrete with a minimum 28-day compressive strength 2500 pounds per square inch, using at least 4 sacks of cement per cubic yard, 1-inch maximum size aggregate, maximum 3-inch slump, and 2 percent to 4 percent entrained air.

PART 3 - EXECUTIQN

3.1 INSPECTION

A. CONTRACTOR and his installer must examine the conditions under which the fence and gates are to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

A. Do not begin fence installation, and erection before the final grading and drainage swales are completed, with finish elevations established.

3.3 INSTALLATION

A. Install framework, fabric and accessories in accordance with ASTM F 567.

B. Excavation: Drill holes of diameters and spacings shown, for post footings in firm, undisturbed or compacted soil.

1. If not shown on the Drawings, excavate holes to the minimum diameters as recommended by fence manufacturer.
2. Unless otherwise indicated, excavate hole depths approximately 3 inches lower than the post bottom, with bottom of posts set not less than 36

inches below the surface when in firm, undisturbed soil.

a. Spread soil from:excavations uniformly adjadent to the fence line, or on adjacent areas of the site, as directed.

3. When solid rock is encountered near the surface, drill into rock at least 12 inches for line posts and at least 18 inches for end, pull, corner, and gate posts. Drill hole at least 1-inch greater diameter than the largest dimension of the post to be placed.

a. If solid rock is below soil overburden, drill to full depth required, except penetration into rock need not exceed the minimum depths specified above.

C. Setting Posts: Remove loose and foreign materials from sides and bottoms of holes, and moisten soil prior to placing concrete.

1. Center and align posts in holes 3 inches above bottom of excavation.
2. Place concrete around posts in a continuous pour, and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations..
3. Trowel finish tops of, footings, and slope or dome to direct water away from posts. Extend footings for gate posts to the underside of bottom hinge. Set keeps, stops, sleeves and other accessories into concrete as required.
4. Keep exposed concrete surfaces moist for at least 7 days after placement, or , cure with membrane curing materials, or other acceptable curing method.
5. Grout posts set in sleeved holes, concrete constructions, or rock with grout, as specified in Section 31, Grout.

D. Concrete Strength: Allow concrete to attain at least 75 percent of its minimum 28-day compressive strength, but in no case sooner than 7 days after placement, before rails, tension wires, barbed wire, or fabric is installed. Do not stretch and tension fabric and wires, and, do not hang gates until the concrete has attained its full design strength.

E. Top Rails: Run rail continuously through post caps or extension arms, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.

F. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

G. Tension Wire: Install tension wires by weaving through the fabric and tying

each post with not less than 6 gage galvanized wire, or by securing the wire to the fabric.

H. Fabric: Leave approximately 2 inches between finish grade and bottom selvage, except where bottom of fabric extends into concrete. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

I. Repair coatings damaged in the shop or during field erection by recoating with manufacturer's recommended repair compound, applied per manufacturer's direction.

J. Stretcher Bars: Thread through or clamp to fabric 4 inches on center, and secure to posts with metal bands spaced 15 inches on center.

K. Barbed Wire: Install 3 parallel wires on each extension arm; on security side of fence, ulnless otherwise indicated. Pull wire taut and fasten securely to each extension arm.

L. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage, as recommended by the fence manufacturer. Adjust hardware for smooth operation and lubricate where necessary,

M. Tie Wires: Use U-shaped wires conforming to diameter of pipe. Clasp pipe and fabric firmly with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.

N. Fasteners: Install nuts for tension band and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.4 ADJUSTMENT AND CLEANING:,

A. Adjust all fencing and gates and leave in good working condition.

B. Repair or replace any broken or bent components as directed by the ENGINEER.

C. Protect gates and fencing from construction traffic until acceptance of the Work.

END OF SECTION